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Cover

A Frosty Martian Surface—Scientists are convinced that a thin coating of water ice covers the rocks and soil in this photo, taken by the Viking lander 2 at its Utopia Plantitia landing site on May 18, 1979. The appearance of the frost corresponds almost exactly with the buildup of frost one Martian year ago (23 Earth months). The frost remained on the surface for about 100 days. The ice is probably extremely thin, perhaps only a tiny fraction of an inch thick.

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Letter from Washington

Dear Colleagues:

Last June I had the privilege of delivering the keynote address to the Conference on Life in the Universe at our Ames Research Center. Because that subject is an important one and one which is frequently misunderstood, I would like to share my views with you by reprinting the transcript of my remarks:

"We are in a unique time, and in a unique situation. All generations feel that is the case. I think we can make the statement that for the first time we can see what the sketch of the connection between the origin of the universe and ourselves may be. As I understand the situation, it is only a sketch. There are lots of gaps in the chain of connection between the first instants of the universe, the formation of matter, the whole evolution of the universe, the galaxies, the stars, the solar system, the planets, the organic molecules and so on to ourselves. But at least we can say we have a sketch. We have pieces that we think we understand, and there are pieces that we do not understand.

"There are perhaps two gigantic missing pieces in this chain where I think it's fair to say we have hardly a clue. One is at the end nearest ourselves when we contemplate the nature of consciousness; and the other is at the very other end where we contemplate the first instants of the universe. At best, we may simply have reduced the whole problem to a lack of understanding of the beginning, which I suppose could be described as reducing it to a previously unsolved problem.

"At least we have the satisfaction of knowing that a quest for understanding of ourselves has now become more than a blind groping for ideas. It has become a matter of connecting ideas from a distant past through a set of processes of which we have a glimmering and some knowledge, to a present, and looking on beyond that, into some distant future that we can only imagine. Our job now is to begin to test this chain of logic by looking at the universe, and to ask seriously:

" 'If the chain of logic is correct, is it only us?'

"If it is not only us—and that is what the chain of logic implies—then how can we not seek our siblings? How can we not find out who else is part of the same chain of logic? If it should turn out that it is only us, then a very much greater problem is posed for us—how come? And what does that mean for the tasks that we have to set ourselves to next? If the task is to find an understanding of ourselves, and if our understanding of origins implies others, surely we must find the others; but if there are no others, then we have the problem of generating our own next tasks.

"All this understanding comes at a very difficult time for attempts to understand. It comes at a time in which we seem to have a faltering in global and national interest in knowledge for its own sake. We have become hyperpractical and are expected to explain the use of things we don't understand, before we understand them.

"It is a time of the "golden fleece" for SETI, and I presume it will be a time of golden fleeces for other things we try to do. The "golden fleece" idea—the idea that searches, gropings for knowledge whose purpose we don't understand are silly and some kind of a ripoff—results from sheer lack of understanding, lack of imagination and lack of perception of the meaning of the history of the human race.

"It is a lack of understanding of the nature of the increase of knowledge, whether immediately practical knowledge or not, and a lack of understanding of the intellectual risk-taking which is an essential part of any groping for knowledge. In any noisy system, the only way in which we can be sure of making no false alarm errors is to turn the system off. There can be no detections if there is no possibility of false alarm. To grope we must have the possibility of error; the whole game consists of making errors, finding them, and disposing of them.

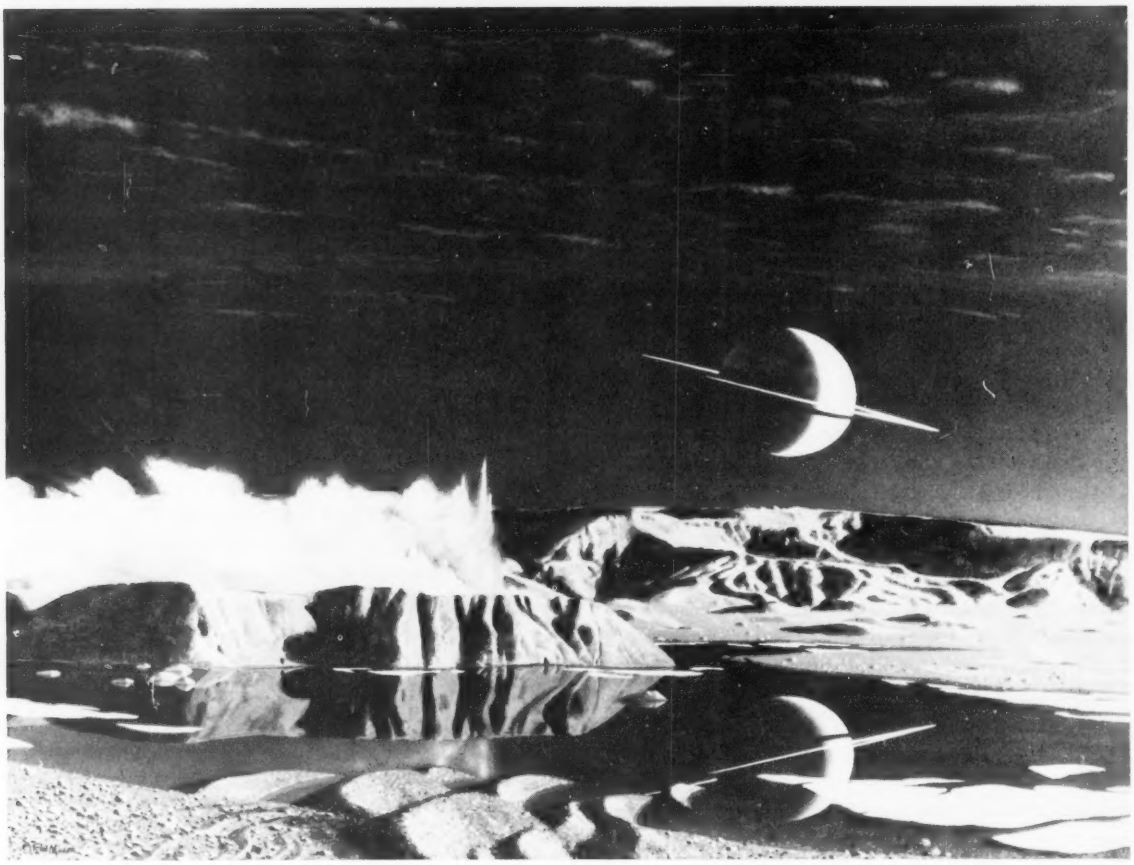
"The second strain of trouble with which we battle in doing this work is the idea that the universe has been around for a long time, so let's postpone the expensive effort to understand it until we have saved the human race. That idea again is backward, a misinterpretation of the nature of our history as a race. The question is not 'how can we pursue knowledge until we have saved the race?' The historical question is more 'how and why should we bother to save the race unless we seek to understand where we came from, who we are, and what the universe around us is about?'

"The very process of saving ourselves is imbedded in, and indissolubly tangled with the process of understanding ourselves and what is around us. The cathedral of knowledge of self cannot be built only from the inside. It must also be built by testing what is built inside against what is outside. Our inner perception must somehow be congruent with the outer fact of the universe in which we are imbedded. What we are doing is not seeking, as is sometimes suggested, only power, technological capability, and what is sometimes described as 'bloodless scientific knowledge.' Scientific knowledge is tied up intimately with our internal attempts to search for ourselves and to understand ourselves because it provides the true context for what we are trying to understand.

"I think it is of profound importance scientifically, socially and philosophically to pursue this subject. I think we are at the point where we must seriously talk about how we do experiments and seek success; we are beyond the point where we can only talk about how we grope. I look forward to the next steps."

Sincerely,

Robert A. Frosch



The View from Titan—Artist Ron Miller envisions how Saturn might appear as viewed from Titan, one of the planet's outer moons. Titan dominates the satellite family in diameter and in mass and it exerts a measurable gravitational force on other bodies in the system. Scientists say its atmosphere is composed mainly of hydrogen and methane, and believe the satellite may have methane lakes that gradually evaporate into the atmosphere. Because of these and other characteristics, Titan is considered to be one of the places in the solar system in which primitive life forms may exist.

President Carter Lauds Apollo Effort

During ceremonies held in the Rose Garden of the White House in celebration of the tenth anniversary of the landing of Apollo 11 on the Moon, President Jimmy Carter said:

"This 10th anniversary, is a great moment for the world. Ten years ago, all humanity watched with wonder as two brave men—Neil Armstrong and Buzz Aldrin, on my right—stepped boldly onto the Moon while a third brave astronaut, Mike Collins, was in lunar orbit. The touchdown of Apollo 11 Eagle in the Sea of Tranquility was a stunning achievement, without precedent in human experience. These three astronauts, representing the spirit of our entire Nation, fulfilled the age-old dream of mankind of venturing beyond Earth to the surface of another world.

"As we honor these three bold adventurers today, we take pride in our Nation and in unequaled technological ability that made this great endeavor possible and which still exists. The pioneer spirit that built our great country is symbolized by the footprints of American astronauts on the bleak landscape of the moon.

"The first lunar landing and those which followed it were due to the unique and the specialized contributions of tens of thousands of Americans—scientists, engineers, astronauts, skilled craftsmen, and many others. We must continue to use these skills and build upon the success and the inspiration of the Apollo program.

"The 10th anniversary of the lunar landing is a time to reflect on what we as a nation can accomplish with unity, daring, and determination. We landed on the Moon because our Nation set a firm goal, and we united behind that effort. Today, we face an equally challenging goal in fighting for energy security. Like the Apollo mission, it is a test of our Nation's resources and our spirit as a people.

"We will win energy security for our Nation in the same way we won the race to the Moon. We will marshal the unequaled technological and scientific capacity of the American people. We will draw upon our vast and abundant natural resources, and we will unite as a people in our determination to preserve our freedom and our independence as a nation.

"I know that the spirit to unite, to prevail, to overcome this energy crisis is strong among the American people today. I've seen it on the faces of those with whom I have met and talked in the last few weeks. I have no doubt that as a nation we will succeed.

"Our Nation will also face a number of other difficult challenges in the years ahead. But this Nation and this Government must be prepared with confidence to meet challenges. I'm now involved in an intense and serious period of review and evaluation. I will make the decisions necessary to ensure that my administration, representing the American people, can provide the leadership this country needs.

"As President, I am also determined to maintain America's leadership in space. The first great era of space exploration is about over; as an initiative, unprecedented. But the second—the era of the Space Shuttle, when we harvest the great benefits that have been made possible by that exploration—is about to begin.

"As the poet Robert Browning wrote over a century ago. 'Man's reach should exceed his grasp, or what's a heaven for?' As a nation, we always must have the boldness to reach for the heavens and to set a brave example for all peoples of this Earth.

"On behalf of the United States of America, I want to repeat the gratitude of our country to these three brave men, those who followed them and preceded them in space, and the many scientists, workers, average Americans, technicians who helped to make this enormous achievement possible. Thank you very much."

Presidential Presentation—Apollo 11 Astronaut Neil Armstrong presents President Carter with an Apollo 11 flag during ceremonies in the Rose Garden at the White House on July 20. Looking on (l. to r.) are: Michael Collins, Edwin "Buzz" Aldrin, Senator John Glenn, Dr. Alan Lovelace standing behind Zbigniew Brzezinski (Assistant to the President for National Security Affairs), Frank Press (the President's Science Adviser), and Dr. Robert A. Frosch.

Skylab Inspection Group Completes Australian Tour

Four men from the Marshall Space Flight Center returned from Australia in late July with a better understanding of the final moments of life of Skylab. They carried with them a few fragments of the fallen spacecraft, gathered from the beaches, wheat fields and sheep paddocks of that distant land.

The four had left Huntsville on July 13, two days after the rugged space laboratory had lost the struggle against gravity, ending its existence in a midnight spectacular that was fully as dramatic as had been its productive life.

Citizens across 965 kilometers of Western Australia had seen the brillant breakup of the 77-ton space machine over the Indian Ocean. Though much of it fell into the ocean, some of it—the heavier pieces—travelled inland and fell harmlessly in a path that turned out to be about 32 km wide and several hundred km long.

NASA wanted to learn more precisely the dimensions of that path, the condition and the exact location of the debris—to learn all that through interviews with eyewitnesses to the disintegration and with those who had found the remains. A secondary consideration was to get small samples of various pieces to see what effects long-term exposure (more than six years) had had on certain materials.

Representing NASA on the trip were Dr. Ray Gause, whose interest was materials; Billy Adair, electronics equipment and trajectory specialist; William Harrison, structures specialist, and J. M. Jones, public affairs officer. They were joined in Los Angeles by Robert Grey of the State Department, who had handled the international aspects of the recent Skylab problem. Grey also was personally familiar with Australia.

Representatives of the Australian Ministry of Science and Environment, and the Ministry of Defense accompanied the group to the western regions where Skylab debris was to be found. Members of all levels of government—federal, state and local, as well as in the general populace—warmly welcomed the group.

A visit to the Perth Entertainment Center revealed that a sizable portion of Skylab and an oxygen tank rested on a stage otherwise occupied by a few score "Miss Universe" contestants who were making ready for an internationally-televised beauty show scheduled for later in the week.

The president of the shire (county) had arranged a mock ceremony in which an officer of the Parks Service ticketed NASA for littering, ". . . the evidence having been found all about the countryside." The townspeople gave the NASA group a reception, and the program included a performance by third-graders of a newly written Skylab song, sung to the tune of "Froggie Went a'Courting."

From Esperance, the group travelled several hundred miles inland to the communities of Coolgardie, Balladonia and Rawlinna, and the city of Kalgoorlie. In Coolgardie, a shopkeeper was observed trying to strike it rich with a public display of a part of the Skylab water tank, charging a dollar for adults and fifty cents for children. The NASA group photographed the display (*without* charge).

At Kalgoorlie a second, almost-complete oxygen tank, a companion to the one at Perth, was on display. Both had been found near the rail town of Rawlinna, a community of 80 people who live and maintain rail tracks on the Nullarbor Plain. The nearest neighbor to the small rail settlement is, in one direction 240 miles, the other 700 miles.

Rawlinna was the site of the end of the Skylab "footprint." The heavier pieces, as yet unfound, probably would be there according to estimates. The group flew in light planes at 300 meters along the track for the range of fuel on hand, coming within about 56 km of the end of the footprint. Vegetation

Prizewinner—The finding of pieces of Skylab near his home in Western Australia netted a $10,000 award for Stanley Thorton, Jr., 17. Thorton was the first to deliver the authentic Skylab debris to the San Francisco paper which paid the reward. He also toured parts of the United States. He is shown with Richard Smith (NASA's Skylab spokesman) in front of the Skylab space station on display at the Smithsonian's National Air and Space Museum in Washington, D.C.

was sparse (it supports one sheep for every 12 hectares), therefore visibility was good, but no sightings of Skylab debris were made. This marked the end of the search, and the group returned to Perth. All agreed that throughout the trip, the Australians had displayed extraordinary assistance and warm friendliness.

Visitors to "Down Under"—Members of the team of Skylab inspectors stopped at Perth, Australia, to inspect a large piece of Skylab debris on display at the Perth Entertainment Centre. (Coincidentally, a "Miss Universe" contest was being held at the centre.) Shown left to right are: William O'Harrison, Dr. Raymond Gause, Mary Friel (Miss USA), guest star Donny Osmond and Bob Grey.

New Communications Satellite

Westar–3, the third in a series of Western Union communications satellites, was launched by NASA from Cape Canaveral on Aug. 9. Westar–1 was launched in April 1974. The second in the series, Westar–2, was launched six months later in October 1974.

The 12-channel satellite will be able to transmit color television, 600 two-way telephone calls or millions of bits of high-speed data for commercial users in the United States.

Westar–3 was placed in geosynchronous orbit over the equator at 91 degrees west longitude, due south of New Orleans and above the Galapagos Islands.

A NASA Delta launch vehicle put the 572-kilogram satellite into a highly elliptical transfer orbit with a high point (apogee) of 36,500 kilometers and a low point (perigee) of 232 km. The angle of inclination is 24.28 degrees.

The Delta launch vehicle project is managed for NASA's Office of Space Transportation Systems by the agency's Goddard Space Flight Center. The Kennedy Space Center is responsible to Goddard for launch operations management. Prime contractor for the Delta 2914 launch vehicle production and launch is McDonnell Douglas Astronautics Co. of Huntington Beach, Calif. Prime contractor to Western Union for the Westar–3 spacecraft is Hughes Aircraft Co., Culver City, Calif.

Aviation Equipment Crash-tested

Langley researchers recently crashed a twin-engine pressurized aircraft as part of the Federal Aviation Administration/NASA general aviation crash test program. The crash test was closed to the public as a safety precaution, since four Falcon air-to-air rocket engines were used to obtain the aircraft's desired velocity.

The full-scale test of the aircraft, using a swinging pendulum approach, is enabling researchers to conduct further studies on structure, seats, restraints and emergency locator transmitters of the 3,500-kilogram aircraft.

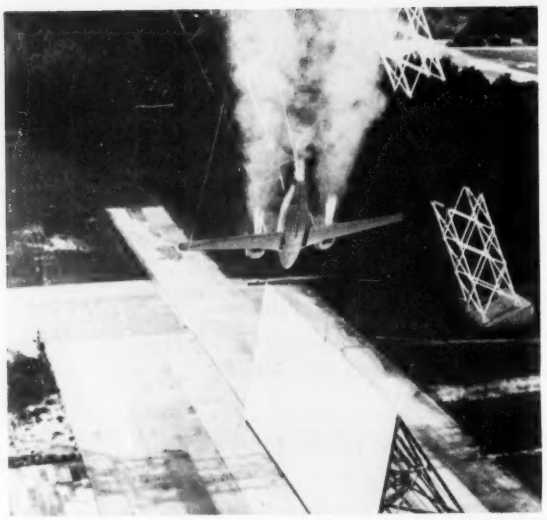
Test speed was 145 kilometers per hour, with a pitch angle of minus 30 degrees and a roll, yaw and angle of attack of zero degrees.

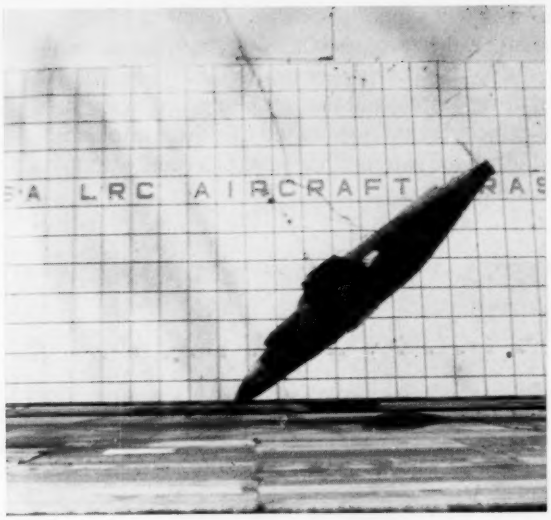
Researchers know that the fuselage must remain intact if occupants are to survive an aircraft crash. If the cabin remains intact, then attention focuses on the integrity of the seat and restraint systems and on seat designs that by their manner of movement can increase the probability of survival and lessen the probability of injury.

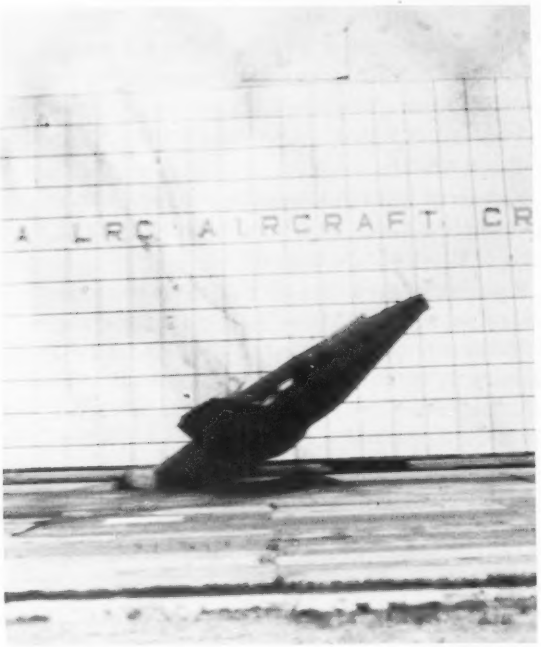
In the recent test, the aircraft was equipped with three modified standard seats and three test seats. The test seats were made up of a very rigid seat, a rocker motion load-limiting seat and a ceiling-mounted (wire bending) load-limiting seat.

The first seat was used to test rails that attach it to the cabin floor and the other two seats were tested to determine their effects on the force-load seated mannequins received in the crash.

The 15-kg ceiling-mounted seat is similar in design to the troop seats designed for Army helicopters. Two load limiters—each with a .25-centimeter diameter wire located inside the seat back







Intentional Crash—This sequence of photographs shows the flight of the twin-engine pressurized aircraft that was crashed at the Langley Research center. The full-scale test of the aircraft, using a swinging pendulum approach, helps researchers to conduct many studies of the aircraft's interior equipment.

and attached to the cabin ceiling—limit both vertical and forward loads. Two additional load limiters, attached diagonally between the seat pan at the front and the floor at the rear, limit the forward loads.

The load limiters are designed to reduce the impact shock felt by a passenger to a tolerable value. They provide a nearly constant force which makes possible the absorption of maximum energy at human tolerance levels over a particular distance.

The rocker motion seat, weighing about 18 kg, uses a rocker swing motion to change the attitude of an occupant from an upright seated position to a semi-supine position. This action theoretically redistributes vertical impact forces on the seat pan traveling up the spine to a larger area on the seat back perpendicular to the spine. The load limiters are located at the bottom of the legs and parallel to the floor from front to back.

Researchers also conducted tests on two different types of emergency locator transmitters, called ELTs. Each ELT is equipped with a sensor which, upon impact, activates a transmitter. Acting as a locator for downed aircraft, the transmitter sends a signal on the air emergency frequency. In the past, however, hard landings or slamming doors caused numerous false alarms. Researchers are investigating the structural mounting, location, and orientation in the aircraft of the ELTs to alleviate false alarms and make the system more reliable.

One of the ELTs on the test plane was mounted with an external antenna on the tail and the other was mounted (with the complete system) in the cabin. The ELTs' activation was monitored by the researchers during the crash test. Batteries for ELTs, after activation, normally have an operating capacity of only 48 hours, therefore a downed plane must be located quickly. When a plane is overdue at its destination, aircraft operators in the area are asked to turn to the emergency frequency to help trace its whereabouts.

In the future, NASA will have a satellite that will continuously monitor the emergency frequency. If the concept is to be successful, the performance of the transmitters must be made reliable and free from false alarms.

U.S. and Soviet Scientists Study Space Physiology

The first joint U.S./U.S.S.R. study to investigate physiological changes in humans resulting from simulated weightlessness began in July at the Ames Research Center. The two Soviet participants, both medical doctors, were Valeriy Mikhailov, project manager for the Soviet phase of the study, and Anatole Grigoriev, one of the principal researchers for the project.

The July-August tests at Ames constitute the second phase of the study which began in May when two NASA scientists, Drs. Harold Sandler (Ames) and Carter Alexander (Johnson Space Center), visited the Soviet Union. The two participated as observers in an experiment at the Moscow Institute of Biomedical Problems.

The study is expected to help standardize physiological measurements and techniques for studying cosmonauts and astronauts. Scientists also expect the study to improve bedrest test procedures, help reduce duplication in the testing of human volunteers, and increase the flow of information between the two countries.

In October, the United States and Soviet teams will meet to discuss results of the study and talk about the possibility of future collaborative efforts.

The joint study consists of two nearly identical experiments, each involving 10 persons aged 35 to 40 years. The weightless environment of spaceflight is simulated by subjecting them to extended bedrest. Each experiment lasts for five weeks with two weeks of controlled observations, one week of bedrest and two weeks of post-bedrest measurements. Stress tests of the cardiovascular system, as well as extensive analyses of blood and urine samples, are performed.

Five of the subjects will remain horizontal while the other five complete the bedrest period with their heads lowered six degrees from the horizontal. In the past, similar studies in the United States have been conducted mostly with subjects in the horizontal position, but Soviet scientists in recent years have abandoned the horizontal procedure in favor of the head-down tilt. The joint study is expected to determine which procedure is more effective.

Space Settlements and Allied Concepts

NASA's Office of External Affairs recently issued the following information document concerning settlements in space.

A number of newspapers, magazines, technical journals, and other publications have in the past few years reported on various aspects of establishing space settlements. Most of the articles differed as to cost, the technology required, the time frame, and the size and functional capabillities of individual or clustered settlements. The information sheet is designed to respond to the many queries NASA has received as to the status of the space settlement matter.

1. Space settlements are no longer being studied by NASA. A workshop study was conducted in 1975 to explore the space settlement concept.
2. Establishing settlements in space would be very costly. Both the hardware required and the technology needed have not been developed. The number and background training of people to occupy a settlement is unknown.
3. *There is within NASA no recognizable need for a space settlement project now or in the near future.*
4. NASA has no plans at this time to establish a space station on the lunar surface.

Available for those interested in the subject is "Space settlements—A Design Study,"* an 185-page, fully illustrated book, from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, $5.00, stock number 033–000–00669–1.

The book is a report which grew out of a 10-week program in engineering systems design held at Stanford University and the Ames Research Center during the summer of 1975. The program was sponsored jointly by NASA and the American Society for Engineering Education and directed by the Ames Research Center and Stanford. Participants included 19 professors of engineering, physical science, social science and architecture, and three volunteers, six students, a technical director and two co-directors.

The co-directors were Richard Johnson of NASA and William Verplank of Stanford. The technical director was Professor Gerald K. O'Neill of Princeton University, author of a number of articles on space settlements published here and abroad. The group worked for 10 weeks to construct a picture of how people might permanently sustain life in space on a large scale.

A similar meeting was held during the summer of 1976. No report of that group's activities so far has been published.

The following literature on the subect may be ordered from the American Institute of Aeronautics and Astronautics, 1290 Avenue of the Americas, New York, NY 10019:

"Space Manufacturing Facilities 1, Space Colonies"
"Space Manufacturing Facilities 2, Space Colonies"
"Space-Based Manufacturing From Nonterrestrial Materials—Volume 57"
"Materials Sciences in Space With Application to Space Processing—Volume 52."

* The word "settlement" has been substituted where "colony" and its form appear in the report to avoid the implication of U.S. sovereignty in space. The U.S. has no more claim to space than any other nation.

NASA and Japanese Identify Cooperative Study

The Joint NASA/Space Activities Commission of Japan study group has completed its work and submitted a final report to NASA Administrator Dr. Robert A. Frosch, and Dr. Tsuyoshi Amishima, Acting Chairman of the Space Activities Commission. The joint study group was established last year to assess areas and methods of possible additional cooperation in space projects between NASA and Japan.

The group's report recommends initiation of preliminary steps that could lead to joint projects in the following areas:

- study of winds and waves associated with typhoons
- study of ocean dynamics
- study of marine resources
- measurement of cloud height by satellite stereography
- reception of Marine Observation Satellite–1 data
- snow properties research
- potential evaporation studies
- study of crustal plate motions
- exchange of experimental communications satellite data
- collaborative study of Halley's Comet
- pre-entry science packages for the Saturn orbital dual probe mission

- trans-Pacific balloon project
- X-ray astronomy
- joint tether project
- origin of plasmas in Earth's neighborhood program
- collaborative solar studies
- Spacelab life sciences studies.

Selected projects will be implemented by appropriate agreements between NASA and its counterpart agency in Japan.

In its review of potential areas of cooperation, the study group examined concepts for joint projects of mutual interest. The projects under consideration include both immediate efforts—the study of ocean winds and waves using existing satellite and surface truth data, for instance—and future efforts, such as the Saturn orbiter dual probe mission. (The latter is in early planning stages and is not an approved mission at this time.)

Responsibilities to be assumed by each side will be consistent with their respective scientific, technical and funding capabilities. Each side will fund its own activities.

Cooperative Japan/U.S. Studies—NASA's Dr. Anthony Calio (left) greets Japanese Science Councillor Shozo Shimormura at the most recent meeting of scientists and technologists from the two countries.

The study group, which was proposed by NASA during a meeting between Dr. A. M. Lovelace, NASA Deputy Administrator, and Dr. Amishima, on July 17, 1978, met three times during the past year. The final meeting was in Tokyo last June.

NASA members of the study group, led by Dr. Anthony Calio, Associate Administrator for Space and Terrestrial Applications, consisted of seven specialists. Heading the Japanese membership was Shozo Shimomura, Science Councillor, Science and Technology Agency. It consisted of 11 specialists and a number of observers.

HiMAT Research Plane Makes First Flight

The first flight of a new NASA–U.S. Air Force research vehicle built to investigate advanced technology that could lead to much greater maneuverability in future military aircraft took place July 10 at the Dryden Flight Research Center.

Called HiMAT (highly maneuverable aircraft technology), the small, radio-controlled research craft is expected to be able to sustain twice the turn rate of present-day fighter aircraft at transonic and supersonic speeds.

Because the concept includes so many high-risk technical advances, it was decided not to man-rate the research plane, but to fly it by using remotely piloted research vehicle techniques developed by NASA several years ago. These permit piloting the vehicle from the ground, and therefore represent an economical and safe method of flight-testing high-risk technoolgy.

Incorporated in the plane are several new advances. Flight-testing the newly introduced technology in one vehicle all at once makes possible the study of the interactions of one advance with another to produce the most efficient results.

The research vehicle was designed from the start to be built with about 30 percent composite material. In addition to the weight savings, the composite material allows for "aeroelastically tailoring" the wings and canards (the smaller forward set of wings) for increased maneuverability and performance. Both sets of airfoils are aeroelastically tailored to twist and bend in flight in the most favorable shape, to achieve maximum performance for the particular flight conditions. The vehicle uses the increased lift from the combination of the canards and wings to increase maneuverability at both subsonic and supersonic speeds.

The plane uses a digital fly-by-wire (electric) control system instead of a conventional control system. Pilot commands are fed via telemetry to an onboard computer which then sends electrical commands to the flight control surfaces. Fly-by-wire flight control systems are lighter in weight and more versatile in terms of automatic features than conventional systems.

The plane also incorporates an integrated propulsion system with a digital computer to provide control of the aircraft's entire propulsion system, instead

of a conventional hydromechanical system. The system integrates control of the jet engine and nozzle and permits optimum performance without adverse interaction.

The research vehicle also incorporates active control technology whereby the flight control system provides basic aircraft stability. Use of this technology saves weight and increases performance since the size of the normal stabilizing surfaces can be reduced.

Winglets, small vertical extensions of the wing tips, provide additional stability and performance.

In addition to studying the various new technologies and their interaction, flight test data will be fed into the differential maneuvering simulator at the Langley Research Center for an assessment of a full-scale fighter's capabilities based upon flight verified aerodynamic characteristics. Use of these results in the simulator allows for a military assessment of the capabilities of the aircraft against specific adversaries.

The research plane, with a wing span of just over 4½ meters and a length of 7 m, is a 44 percent scale model of a 7,711-kilogram fighter. It weighs 1,542 kg at launch. Powered by a General Electric J–85 jet engine, HiMAT should be capable of speeds in excess of Mach 1.5 (one and one-half times the speed of sound) or about 1,600 kilometers per hour.

The plane was air launched, with its jet engine running, from a B–52 flying at 14,000 m. The pilot in the ground cockpit then took full control and flew the entire mission including landing on the dry lake bed at the Dryden center. If required, back-up flight control is available through a two-seat F–104 chase aircraft.

Two vehicles were built by the North American Aircraft Division of Rockwell International for approximately $17 million. The concept is a joint NASA-U.S. Air Force program sponsored by NASA's Office of Aeronautics and Space Technology. The Dryden center has overall program responsibility with assistance provided by the Air Force's Flight Dynamics Laboratory, Wright-Patterson Air Force Base in Ohio.

Firefighting Module Is a Cooperative Effort

The problem of putting out fires on ships has long been the subject of a cooperative project carried out by the Marshall Space Flight Center and U.S. Coast Guard. Marshall directed the development of a lightweight but powerful firefighting module. The Coast Guard is giving it operational tests. Recently the module was demonstrated in St. Louis, Mo.

Testing Module—U.S. Coast Guardsmen on a 10-meter boat get training and experience while performing operational tests of the lightweight firefighting module in Mobile Bay. The unit, seen here just aft of the boat's cabin, was developed under direction of the technology utilization office at the Marshall center.

The unit performed "very satisfactorily" in tests by the Coast Guard at Mobile Bay (Ala.) early this year. It was used in extinguishing simulated shipboard fires, such as cabin fires and ship's furniture.

The module was then disassembled, inspected for wear and reassembled to resume tests. The Coast Guard has tentative plans for setting afire a derelict ship in Mobile Bay and extinguishing it through use of the module.

The firefighting module is about ¼ meters wide, 1½ m high and 1¾ m long, light enough to be carried on a two-wheel trailer, a pickup truck or a small boat. It can also be moved by helicopter sling.

Water is sucked from a river, lake or the sea through a large hose at the rate of more than 7,570 liters per minute and forced through two nozzles at a

velocity sufficient to allow firefighters to position themselves at a relatively safe distance from the fire.

Coast Guard tests are proving the capability of the module to fight fires and are giving crewmen vital training in its use.

Some immediate uses envisioned are: a truck or trailer mounted unit parked on a pier to put out a fire aboard a docked ship; a unit on a boat rushed from the pier to a ship anchored in the harbor; or a module air-lifted to a boat near a ship offshore. The firefighting module also could be used at riverside or lakeside sites difficult to reach by conventional fire-trucks, and could be used as an emergency pumping unit in flood situations. It has potential for numerous other applications, including irrigation.

The unit evolved from aerospace technology, specifically from the efficient, lightweight pumps developed originally by Marshall center engineers for rocket engines.

At the conclusion of tests, a port city will be selected where a firefiighting unit will be installed for training and operational use.

Development of the firefighting module is under the direction of the Marshall center's technology utilization office, headed by Aubrey D. Smith. The coordinator is Ismail Akbay and the project engineer is Ralph A. Burns of Marshall's structures and propulsion laboratory.

Lunar Module Exhibited at United Nations

During recent ceremonies at United Nations headquarters commemorating the tenth anniversary of Apollo 11, a full-scale model of the lunar model was placed on display in front of the public entrance to the UN.

In his dedication remarks, NASA Administrator Dr. Robert A. Frosch said:

"The United Nations has played a constructive and productive role in the space area, aided in recent years by the fact that the Secretary General is a former chairman of the Committee on Peaceful Uses of Outer Space and has an abiding interest and a solid background in space-related matters.

"I find the exhibit we are dedicating today to be highly appropriate as a symbol of mankind's triumph ten years ago when we first broke the shell of atmosphere and gravity and reached out to touch another body of the solar system. The lunar module is unique in the literal sense. Nothing else has ever been designed by NASA with such an awkwardly functional appearance and it is improbable that we will see anything like it again soon. In that uniqueness it symbolizes the equally unique achievement for which it was the final vehicle.

"No matter what our other accomplishments in space are—and I am confident there will be many—few will ever rival the sheer drama and primal significance of those first footsteps on the Moon when, after all the eons of upward striving from the African savannahs and the Ice Age tundras, humanity first broke the bonds of Earth and gained initial access to the Universe."

In Memory of Apollo 11—Acting U.S. Representative to the United Nations Joseph McHenry (left) presents a small model of the lunar module to U.N. Secretary General Kurt Waldheim, at ceremonies commemorating the landing of the first man on the Moon.

Water Hyacinth Film Shot at NSTL

A New York-based production company recently spent two days filming at NASA's National Space Technology Laboratories for a Public Broadcasting Service program scheduled to be presented later this year.

According to Dr. B. C. Wolverton, NASA environmental scientist, a six-man crew of Richter, McBride Productions Inc. filmed various aspects of the NSTL vascular aquatic plant program which Wolverton heads.

"The Environmental Protection Agency is supporting the whole film for public showing," Wolverton said. He added that the film will show "how new technology is beginning to convert waste into an asset rather than a liability."

The program entitled "Water Cycle," will include segments filmed at Disney World, where Wolverton is working with EPA officials in establishing a wastewater facility. Portions also were filmed at California and Texas locations. Indications are that a large segment of the program may focus on NASA projects.

Crew members told Wolverton that the NSTL locale "was the most interesting one" they had filmed.

Wolverton said, "The part that really got them excited over our work here is that the water hyacinths or duckweed that we use to treat the waste can be converted into energy and feeder fertilizer at one and the same time."

Michoud Is Meeting Energy Goal

The people at Michoud Assembly Facility, New Orleans, have pitched in to implement an extensive energy conservation plan—and are succeeding despite tremedous increases in demand for energy.

Demand for energy took a big jump when NASA called upon the plant to gear up for production of the external tanks for Space Shuttle. Last year alone, electricity and natural gas used in the 1.2 million square-meter plant cost $4,175,000.

All personnel is involved in saving energy, from individuals to the large contractors. Individuals save much energy simply by remembering to turn off lights and close doors.

Mercury vapor lights have been replaced by sodium vapor for twice the light at half the use of energy. Water temperature in restrooms has been lowered 25 degrees. Air conditioning is turned on only when employees begin arriving and off as soon as they leave. Also, the design of new facilities always incorporates energy efficient features.

Michoud's goal, set in 1973, was to reduce energy consumption by 50 percent by 1985. They are now at 41 percent of their goal, despite the increase in demand.

Students Again Take Part in Langley Career Program

For the eighth consecutive year, gifted high school students from Virginia participated in an eight-week summer career exploration program sponsored by the Langley Research Center's office of education and community services.

Through the Hampton City Schools Gifted Students Program, youngsters are given an opportunity to work with NASA sponsors in areas related to potential career fields. After an intensive selection process, students are assigned to sponsors in the areas of science, computers, engineering or mathematics, depending on their interests.

Throughout the program, students are exposed to several scientific and technical work environments that enable them to see how research techniques and scientific concepts studied in the classroom are applied in work situations.

For the first time this year, the students were paid $2.50 an hour while they received on-the-job training. Students assisted professionals and technicians in computer science, wind tunnel research, energy efficient research, environmental engineering, architecture, and other fields.

Learning Space Skills—Groups of local students work and study at the Langley center each summer. Assembled above is the 1979 group with school system officials and (at far right, kneeling) Harold E. Mehrens, head of the Langley center office of education and community services.

Kline Becomes Deputy Administrator of GSA

Ray Kline, until recently, Associated Administrator for Management Operations at NASA, left the space agency to become Deputy Administrator of the General Services Administration.

Kline assumed his management operations job at NASA in 1977. In that position, his leadership was outstanding in NASA's implementation of the Civil Service Reform Act. From 1975 to 1977 he served as Assistant Administrator for Institutional Management. He has been intimately involved in institutional management and resource issues since coming to headquarters in 1968. He joined NASA in 1962 and served for six years in various management capacities at the Marshall Space Flight Center.

Administrator Robert A. Frosch said: "Kline's experience and expertise in center and headquarters management will be sorely missed at NASA. He takes with him a large store of practical knowledge which will stand him in good stead in his new job. We all wish him well."

Glen Wilson Appointed to New NASA Job

A new position, designated "Special Assistant for Student Activities," has been approved for the Office of External Relations. The special assistant will serve as an advisor within the agency for forming policy and assisting in the coordination of NASA's interactions with students and those programs that involve students—the student Shuttle project, for example.

The special assistant will encourage and expedite student participation and involvement that contribute to NASA's programs and activities and also will seek to gain wider participation and sponsorship of industry and other outside groups in NASA's student activities and programs.

The special assistant also will manage those unique student programs that have agency-wide scope and interest and are not the direct responsibility of other units of NASA.

Wilson, an employee of the U.S. Senate for 23 years, was a staff member of the Senate Special Committee on Space and Astronautics. He participated in the writing of the National Aeronautics and Space Act of 1958 and later served on the Senate Committee on Aeronautics and Space Sciences throughout its entire existence from 1958 until the Senate reorganization in 1977.

Wilson was born in Waco, Texas in 1922. He earned a B.S. in Aeronautical Engineering in 1943 and an M.A. (1948) and Ph.D. (1952) in Psychology, from the University of Texas. He worked briefly at the Lockheed Aircraft Co. before serving two years in the U.S. Navy. After the war, he was a student, teaching fellow, research assistant, and instructor at the University of Texas, and research psychologist for the U.S. Air Force.

In 1976 he was awarded a Special Presidential Citation by the American Institute of Aeronautics and Astronautics.

Director Appointed for New Spacelab Division

The Spacelab mission integration division recently was established in the Office of Space Science, NASA headquarters, through a consolidation of various functions of the Office of Space Science and Office of Space and Terrestrial Applications.

Jesse W. Moore has been named director of the new division. In this position, he is responsible for planning, development and operation of NASA missions which use the Shuttle/Spacelab system, and other Shuttle-attached payload carrier and space platforms to accomplish the objectives of NASA's space science, applications and technology programs. In addition, he is responsible for developing and maintaining a comprehensive plan for Spacelab usage and for maintaining a user-derived, coordinated set of launch requirements for all future NASA Shuttle payloads.

Before he assumed his new position, Moore served as the deputy director of the solar terrestrial division, in NASA's Office of Space Science. He came to NASA headquarters in July 1978 from the Jet Propulsion Laboratory where he served as the science and mission design manager for the Galileo project. From 1966 to 1978 he held several management positions at JPL, including that of deputy manager for the flight projects planning office.

Born in Newberry, S.C., Moore earned a MSEE from the University of South Carolina in 1964.

Affirmative Action Award to Jenkins

Harriett G. Jenkins, director of Equal Opportunity Programs at NASA, recently was granted the Affirmative Action Award by the Department of Health Care and Public Administration at the C. W. Post Center of Long Island University.

The award was given in recognition of her excellence in management, leadership and public service.

Jenkins chaired the Task Force on Equal Opportunity and Affirmative Action, one of the nine task forces for the personnel management project, which was part of President Carter's reorganization efforts.

She also was a major contributor to the American Society for Public Administration task force on equal employment opportunity and affirmative action, which produced the policy statement of equal opportunity, affirmative action and support of federal EEO activities. That statement was unanimously adopted by the ASPA National Council on April 4, 1979. Jenkins currently chairs the ASPA Professional Standards and Ethics Committee.

New Director of Equal Opportunity Office at MSFC

Clyde Foster has been named director of the Equal Opportunity Office at the Marshall Space Flight Center. Foster has been with the center since it was established in 1960. He worked for many years in computer-related fields at MSFC.

He was assigned to the Equal Opportunity Office in 1972, soon after it was established. Three years later he became deputy to the office director, Arthur E. Sanderson, who retired in May.

Off-duty, Foster serves as the mayor of the nearby town of Triana, Ala. In 1964 he was instrumental in the restoration of the town's charter, which was first granted in 1819.

Foster holds a degree in mathematics from Alabama A&M University, Huntsville.

Contractor News

TWA Services, Inc., the incumbent concessionaire in charge of the operation of the public visitors program at the Kennedy center since 1966, has been selected for negotiation of a new 10-year contract for similar services.

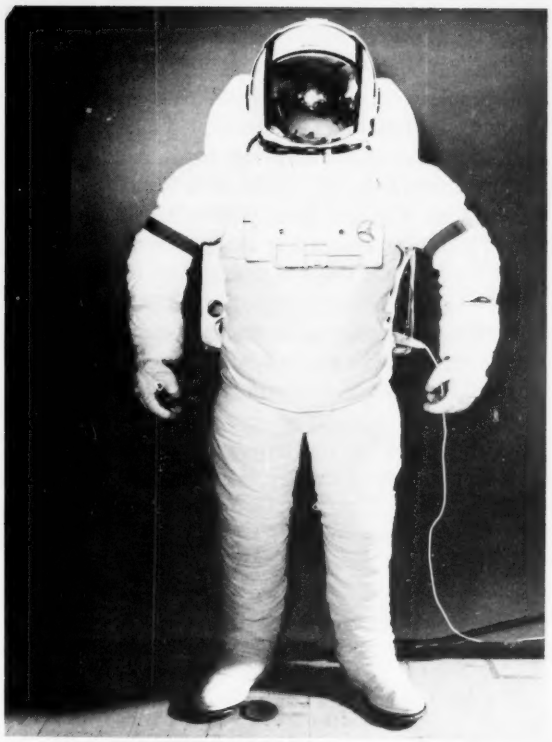
Kaman Aerospace Corp., of Bloomfield, Conn., has won a $1.5 million contract for design and fabrication of composite blades for use on a 2-million watt wind turbine generator in Boone, N.C. The cost-plus-fixed-fee contract will run for 14 months under the management of the Lewis center, directed by the DoE. Under the NASA/DoE program, the wind turbine at Boone will become the third in a series. The Boone generator will have ten times the generating power of the other two, operating in New Mexico and Puerto Rico.

The Frank Briscoe Co., Inc., of East Orange, N.J. has been awarded a contract for construction of the rotating service structure of pad B, launch complex 39, at the Kennedy center. The fixed price contract for $18 million calls for labor, materials, services and equipment necessary to fabricate and install the structure, which will provide protected access to the Space Shuttle orbiter for installation and servicing of payloads.

Pan American World Airways, Inc., Aerospace Services Division at Cocoa Beach, Fla., has won a $2 million-plus contract extension for occupational medicine and environmental health services at the Kennedy center. The extension, the third, brings the cumulative value of the parent contract to $7 million.

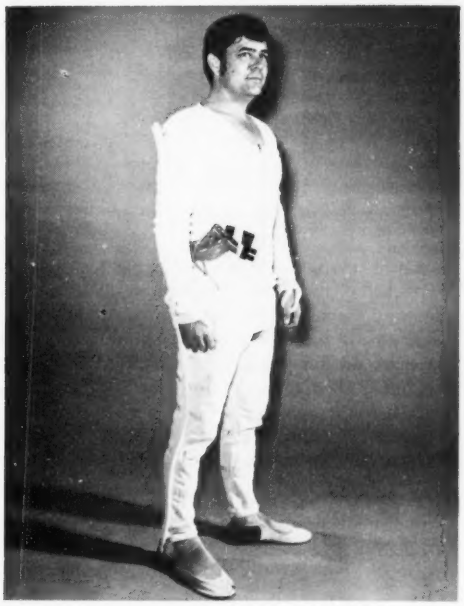
The TRW Defense and Space Systems Group of Redondo Beach, Calif., has received a $1 million contract for the furnishing of equipment to be used in the checkout of Space Shuttle payloads at the Kennedy center. The contract calls for the manufacture of a payload interrogator and a payload signal processor, to be part of the payload interface verification system.

The Alabama Division of the Thiokol Chemical Co. of Ogden, Utah, has won a NASA option for 27 additional motors as part of an earlier contract award. The $4.3 million contract is for the purchase of 12 solid propellant rocket motors. Called CASTORS, the solid-propellant rockets are strapped to the outside of a Delta launch vehicle to provide added lifting power. Delivery of the initial 12 CASTORS is scheduled for January or February 1981.



For Walking and Working in Space—The extravehicular mobility unit to be worn during Space Shuttle flights when astronauts must work outside the orbiter vehicles is modeled at the Johnson center's crew systems laboratory.

Escape Suit—This ejection escape suit will be worn during Space Shuttle orbital flight tests aboard *Columbia*. It is a modified version of a U.S. Air Force high-altitude pressure suit.



Futuristic Long Johns—This liquid-cooled undergarment will be worn with the Space Shuttle suit, called the extravehicular mobility unit. The special tubing at the waist runs the entire length of the body.

Films and Publications

A new 28-minute motion picture recently has been released which depicts career opportunities in NASA for minorities and women. It is entitled "Where Dreams Come True" and designated HQ–296. Each center EEO office and all NASA regional film libraries have copies. Actor Ricardo Montalban is narrator and host. The film was shot on location at KSC, JSC, ARC and DFRC. The participants include NASA scientists, biologists, managers, astronaut selectees and others in Space Shuttle related activities. The film took more than a year to make. It was produced by a New York film company, William Greaves Productions. NASA Headquarters' Ken Grimm was the production supervisor and Curtis Graves was technical advisor.

The National Archives and Records Service, General Services Administration, Washington, D.C., is showing 13 motion pictures related to America's explorations of space. Showings began Aug. 16, continue until Oct. 26, admission is free.

An index of NASA films, publications and television programs concerning energy education is available from the office of educational research (LFG–13) at NASA headquarters. The list covers scientific and technological research in aeronautics and space which relates to NASA-Department of Energy programs. For information about other energy education materials, inquiries may be directed to: Education Programs Division, Mail Stop 80031, U.S. Department of Energy, Washington, D.C. 20585.

Protecting Shuttle from Vibrations—This waterfall effect is achieved in the course of designing a sound suppression system at the Kennedy center to cushion Space Shuttle payloads from acoustic vibrations during launch. The system dumps 8,100,000 liters onto the launch pad during a 30-second period; at peak flow, three times that amount of water flows through the system.

Looking into Life Forms—Left to right, Drs. Bernard Campbell of the Leakey Foundation, A. G. W. Cameron of Harvard University, Philip Morrison of MIT, and James Valentine of the University of California at Santa Barbara, meet the press at Ames Research Center during a recent conference concerning "Life in the Universe." The conference brought together for the first time more than 200 experts in many disciplines to explore prospects for research into the nature and distribution of life in the universe.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title	Patent No.	Installation
Richard A. Campbell, MSFC	Radiation Shadow Detector	4,159,576	MSFC
Edwin O. Stengard, GSFC	Toggle Mechanism For Pinching Metal Tubes	4,159,634	GSFC
Thomas E. Wise, Bendix Field Engineering Corp., Columbia, Md.	Microwave Dichroic Plate	4,160,254	GSFC
John K. Salisbury, Stanford Univ.	Controller Arm For A Remotely Related Slave Arm	4,160,508	ARC
Jacqueline M. Jacobs, JPL	Biocontamination And Particulate Detection System	4,160,601	NRLO
William S. Dwinell, Rockwell Intl. Corp. Space Div., Downey, Calif.	System for Automatically Switching Transformer Coupled Lines	4,161,661	MSFC
Thomas A. Barr, MSFC	Thickness Measurement System	4,161,731	MSFC
Donald E. Jennings, Natl. Acad. of Science, Washington, D.C.	Shock Isolator For Operating A Diode Laser On A Closed-Cycle Refrigerator	4,161,747	GSFC
John B. Schutt, GSFC	Alkali-Metal Silicate Binders And Methods Of Manufacture	4,162,169	GSFC
Stanford Ollendorf, GSFC	Thermal Control Canister	4,162,701	GSFC
Neal Franklin Shepard, Jr. General Electric Co., Phila., Pa.	Solar Cell Module	4,162,928	NRLO

Launches for 1979

Name	Launch Date	Vehicle	Range	Mission Remarks
SCATHA	Jan. 30	Delta	ETR	DoD R&D. Spacecraft charging at high altitude Reimbursable.
SAGE-A	Feb. 18	Scout	WFC	NASA applications satellite. Stratospheric aerosol and gas experiment.
FLTSATCOM-B	May 3	Atlas Centaur	ETR	DoD Navy communication satellite. Reimbursable.
NOAA-A	June 27	Atlas-F	WTR	NOAA weather satellite. Reimbursable.
UK-6	June 2	Scout	WFC	UK scientific satellite. Reimbursable.
Navy 20, C/U	July 20	Scout	WTR	DoD Transit Reimbursable.
Westar-C, C/U	Aug. 9	Delta	ETR	Western Union communications satellite.
HEAO-C	Sept. 15	Atlas Centaur	ETR	Third high energy astronomical observatory to study highly energetic radiation from space.
MAGSAT-A	October	Scout	WTR	NASA applications satellite to study magnetic field.
FLTSATCOM-C	November	Atlas Centaur	ETR	DoD Navy communications satellite. Reimbursable.
Intelsat V-A	December	Atlas Centaur	ETR	Intelsat communications satellite. Reimbursable.
RCA-C	December 7	Delta	ETR	Domestic communications satellite. Reimbursable.

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Aid to Solar Collector Development

An instrument that measures the degrees of radiant energy emitted through various coatings, called the McDonald Emissometer*, is useful to companies engaged in development of solar energy collectors. Originally developed by NASA, the system is manufactured for the commercial market by the International Technology Corp., Satellite Beach, Florida.

Solar heating and cooling systems employ coatings to increase efficiency. Designers want a coating which absorbs solar heat to the maximum extent possible with minimum emission of infrared radiation, which occurs when the collector plate gets hot. The coating is important because too much coating causes energy loss by emission, too little reduces the collector's ability to absorb heat.

NASA's Lewis Research Center, which conducts solar energy research, saw a need for a simple means of testing coating samples for emissions. Such equipment is available to research laboratories, but it is complex and expensive. To provide an equally accurate but relatively low-cost system for wide use by manufacturers of solar equipment, Lewis undertook development of the emission measuring device in conjunction with Willey Corp., Melbourne, Fla., and the Institute of Optics, University of Rochester, New York.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of such technology.

In use, the Emissometer is placed above a heated sample and the radiation from the sample is focused on a detector within the instrument. Rising temperature, determined by heat sensing equipment, indicates the degree of emission, which is measured and displayed on a meter. The Emissometer permits easy testing of various experimental coatings and also helps determine how the coatings will react to increases in temperature or time in use, information important to development of efficient solar collectors.

Testing "Emissivity"—An engineer determines the amount of solar energy that comes through a particular coating to be used on heating and cooling systems.

For the benefit of all . . .

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